British Islands and the more temperate parts of Europe it is very possibly only the young of this species which migrate, and the adults, having once fixed on a place of residence, may stick to it; so that here we have a case which will almost bear out Mr. Wallace's supposition. With this, however, he stops, and I am sorry to say offers no suggestion as to the way in which migration is effected.

The question which Mr. Romanes puts would be more appropriately answered by Mr. Tegetmeier, and I hope he will be induced to do so. I can only say that that gentleman has repeatedly urged his views on me in conversation and upon the public in his books (see "Pigeons, their Structure," &c., pp. 84, 85, and "The Homing or Carrier Pigeon," pp. 37—42, 105—118) which, being ready of access, I need not here quote. To limit myself to what I am alone answerable for, I would say that when declaring that sight alone cannot be much aid to birds while migrating, I had especially in mind the almost peculiar case of the Scandinavian form of Bluethroat (*Ruticilla surcica*), which winters in Egypt and the Nile Valley, and summers in the northern or mountainous parts of Sweden, Norway, Finland, and Russia; while, though no doubt passing regularly twice a year over the intervening countries of Europe, it is there so singularly scarce as to have been, until of late years, almost unknown to the best of German ornithologists. For the benefit of such of my readers as are unacquainted with the bird, I may add that the cock has a conspicuous and beautiful plumage, a fine song, and habits which, in the spring of the year, cannot be called unobtrusive. If, therefore, it did commonly occur in Germany—where I should state that a kindred form (*Ruticilla leucocyana*) is very well known—it could not escape observation. Wonderful as the feat looks, it would therefore seem as though this Scandinavian Bluethroat passed over Europe at a stretch, and if so, I cannot conceive its flight being guided by any landmarks.

Furthermore, there is ground for believing that some of the migrations of many species, particularly of water-birds, are performed at night, when sight, one would think, can be of little use to them. But, to be honest, I must confess that dark, cloudy nights seem to disconcert the travellers. On such nights the attention of others besides myself has often been directed to the cries of a mixed multitude of birds hovering over this and other towns, apparently at a loss whither to proceed, and attracted by the light of the street-lamps.

One other point only need I now mention; this is Mr. Romanes's assertion that "in the case of all migratory birds, the younger generations fly in company with the older ones," which is at variance with a statement (hitherto, I believe, uncontroverted) of Temminck's:—"On peut pour un fait que les jeunes et les vieux voyagent toujours séparément, le plus souvent par les routes différentes." (Man. d'Orn. ed. 2, iii. Introduction, p. xliii. note.) ALFRED NEWTON

Magdalene College, Cambridge, Nov. 2

Insects and the Colours of Flowers

THERE is one point connected with Mr. Darwin's explanation of the bright colours of flowers which I have never seen referred to. The assumed attractiveness of bright colours to insects would appear to involve the supposition that the colour-vision of insects is approximately the same as our own. Surely this is a good deal to take for granted, when it is known that even among ourselves colour-vision varies greatly, and that no inconsiderable number of persons exist to whom, for example, the red of the scarlet geranium is no bright colour at all, but almost a match with the leaves. RAYLEIGH

Whittinghame, Preston Kirk

Sounding and Sensitive Flames

A SEVERE indisposition, which disabled me from correspondence during nearly the whole of last month, prevented me from acknowledging as soon as it appeared in NATURE (vol. x. p. 244) Prof. Barrett's excellent communication on Sounding and Sensitive Flames, replying to my letter on the same subject at page 233 of this volume. Prof. Barrett supplied me with many useful references, and with one at least the want of which led me to misrepresent his connection with the discovery of sensitive properties in suitably adjusted wire-gauze flames, for which I had sought in magazines and journals for some months previously in vain. A note of the original description of Mr. Barry's experiment in NATURE, vol. v. p. 30, had in the meantime been pointed out to me in another record of very similar experiments, which is itself also, I have no doubt, the same account of "further experiments with the same kind of flame," that Prof. Barrett cites as appearing in the *Journal of the Franklin Institute* for April 1872, to which I have not been able to obtain access. The nearer channel to which I was referred for its perusal is the *Philosophical Magazine* for June 1872, where a paper is briefly extracted from the *American Journal of Science* of the preceding month, describing new experiments with Barry's sensitive flame, by Mr. W. E. Geyer, of the Stevens Institute of Technology, in the United States. By placing a wide tube over the flame at a proper height it became sounding, or, if silent, might be made sensitive in such a way as to sound at the slightest hiss or rustle, and on producing any jingling or tinkling sounds in its neighbourhood. Thus the flame sounded twice on pronouncing to it the word "sensitive," showing its instantaneous affection even by momentary sibilant sounds. By varying the experiment, an opposite condition of the flame was obtained, in which it continued sounding until checked by a hiss or rustle from without. It is observed by the editor of the *American Journal of Science*, in a note to Mr. Geyer's paper, that in the number for September 1871, of the *Moniteur Scientifique*, a form of apparatus and experiment apparently identical with Mr. Barry's is noticed as having been made by Prof. Govi at Turin, and this was a few months prior to the letter in which the account of his experiments is given by Mr. Barry to Prof. Tyndall. Thus the sensitive properties of certain wire-gauze flames, like the property of such flames to excite very readily musical vibrations, may have had many independent discoverers; the value of such discoveries is now, as it must have ever been, the new light which one is capable of throwing upon another. The rapid publication of results urgently requires their frequent collection and comparison together; and this process, pressing and urgent as it is, seldom fails in experienced hands to prove a connection, to bind together a chain of consequences, and to leave a subject in general better explored and embellished with new-found illustrations than it was before. Such was the successful treatment, a few years ago, by Prof. Tyndall, of the question of sounding and sensitive flames, when it was shown by beautiful illustrations of Savart's sensitive water-jets, and by equally ingenious and new experiments with smoke-jets as substitutes for flames, that sensitiveness is a residing property of liquid veins and gas-jets, independently, in the latter case, of their being lighted. The laws of fluid pressure and motion, and apparently foremost of all those of capillary attraction in liquids and of mutual friction and diffusion in gases, and not the energies of heat and combustion of a flame, preside principally over the observed phenomena. The bifurcated head, or low ruffled brush to which the tall wand-like sensitive jet is suddenly reduced, is but the glowing representation of the form which, if it were visible to the eye, the unlighted jet would, under the same circumstances, be observed to take. This is at least in general terms, and perhaps also in plain and fairly accurate statement of the real facts, the simple result which the collection and elucidation of the most brilliant then known experiments illustrating sensitive flames, led a philosopher of Prof. Tyndall's enlightened sagacity and skill in physical investigations to adopt. There can be no doubt of its substantial correctness in the increasing array of cases to which it may be successfully applied. The flame is but an illuminated effigy of some of the lowest parts of the issuing gas column, whether tranquil or disturbed, whose upper parts it removes and replaces by products of combustion. The lower parts are also marred in their form by heat, but not so much as to obliterate the original character, shape, and dimensions of the part of the gas column that it represents. The flame terminates upwards, and ceases to represent the unlighted column further when it has found surface of contact enough with the outer air to effect the complete combustion of the gas. The up-draught of violently heated products of combustion near the base impedes the access of fresh air to parts near the summit of the flame, and it must, besides, deform them otherwise, sometimes even rhythmically, as in the unsteady throbbing flame of an ill-trimmed lamp or of a candle burning in its socket. The noisy roar with which flaring of gas-flames is attended tells us also of the uneven mixture of the gas and air supplies with each other in the flame, and reminds us of the rapid fire of small explosions that must probably introduce new sources of confusion in its form. If these explosions, however, are regularly timed, they can be made to maintain the simple musical note of harmonic flames; and these flames again, wholly dependent as they appear to be

on their combustion for the musical sounds that they emit, must, it appears from Count Schaffgotch's and Prof. Tyndall's well-known experiments, when placed in certain circumstances of silence and indifference in an open tube, be aided by the voice at a distance to commence their song. The signal-note first raises certain mechanical vibrations in the gas-current of the narrow jet, that are necessary in the outset to produce commotions enough of the singing flame to make it able to continue and maintain them. The sensitive sounding-flame of Mr. Geyer bears a similar explanation, for not being regularly adjusted, although very nearly so, to continued sounding, a rustle sufficient to flurry the sensitive wire-gauze flame under the open tube creates in it so many brisk explosions, that the resonance of the sounding-tube is excited, and is at once exalted to a loud note by the rhythmical expansions of the flame; but with the cessation of the external sound the maintaining impulse ceases, and the wire-gauze flame whose commotions must be kept up in order to maintain the note immediately becomes as silent as before.

It is remarkable that the gas-pressure used to obtain Barry's sensitive flame is not sufficient to produce visible sensitiveness in the taper-jet alone; but if the gauze is raised and lowered over the unlighted jet, a proper position is soon found where the cone of blue flame burning on the gauze above possesses a very high degree of sensibility. The use of smoke-jets instead of flames in this arrangement would perhaps give more positive proofs than may yet have been obtained of the cause of the impressibility. It appears, however, scarcely probable that in the short space of a few inches from the aperture the pin-hole current of unlighted gas can increase its amount of air-mixture so much by the influence of external sounds, that this would account sufficiently for the descent of the conical gauze-flame from the pretty stately eminence of a tall and steadily-burning hill top, to little more than the elevation of a stormy bed of low struggling and bustling flame. The alternative supposition is that the disturbance commences in the meshes of the gauze itself, and that it extends upwards from them with such rapidly increasing agitation that a perfect mixture of the gas-current with the surrounding air, and its complete combustion, are thus enabled to take place at very short distances above the gauze.

I have been led to offer these few reflections on some of the most remarkable examples of sensitive and sounding flames from a wish to distinguish in their action as well as possible between the part which purely mechanical forces, and that which the operations of heat and combustion play separately in their production. The mechanical part of the explanation appears to consist in supposing the sensitive jet, when it is properly adjusted, as being in a state either bordering upon, or of actually existing undulation. The hissing sound of all air-jets, if listened for attentively enough, is a proof of the reality of the disturbance; and such sounds, it has been suggested by Sir G. Airy, indicate disruptions of continuity in the air round the nozzle of the jet, arising, no doubt, from the rapidity with which particles of the quiescent external air are there carried off by friction with the gas-current of the jet. It is hardly possible that *vacua* so complete (when they exist) should fail to supply the jet with a succession of smoke-rings encircling it and probably travelling up the jet with different speeds according to their magnitude and the depth to which they are involved in the upward current of the gas. If a disposition to regular periodic action exists in the jet (and the smoother its orifice, and the more steady the supply of gas to the jet, the more probable this appears to be), a succession of smoke-rings* of the same size, and of greater or less strength according to the uniform pressure of the gas, may easily be supposed to course each other up the flame, and being gradually consumed in ascending, to leave its tall column to the top with sides as smooth and even as a rod of glass. But if the gas-pressure is much increased, a phenomenon like that of companion cyclones observed in rotating storms, perhaps presents itself at the orifice of the jet, each strong smoke-ring as it is formed being probably followed by a weaker one (a residual offset from the first) travelling after it with less velocity on the outer surface of the flame. The companion rings are probably overtaken and destroyed at a certain height in the flame by the next following strong ring, and the succession being continuous, a puff at a certain height in the flame, where the companion rings collapse, throws it there into a permanent excrescence or confusion. Both rings may be broken by the shock, and if of oval forms, as they must probably be in some jets, the two projecting halves of the stronger ring when struck, on springing outwards may thus appear to divide the flame at a certain height above the jet into two pointed tongues forking outwards from each other to a certain width. This form of sensitive flame was shown to be readily obtainable by Prof. Barrett by means of a tapering glass quill-tube jet, the edges of which on two opposite sides are slightly ground or snipped away into a V-shaped notch. Besides the secondary or companion ring, tertiary and higher orders of following rings may possibly be formed; and each strong primary ring may have to run the gauntlet of several weaker antagonists before it at last emerges safely, or else is destroyed itself in its conflicts with them. The flame is lowered to a bushy head in the latter case; but if the primaries outlive their shocks, and if, as might sometimes happen also, the secondaries alone survive, it seems possible that a sensitive flame with a short continuation of steady flame overtopping the region of tumult and confusion, could in this way be obtained. The hypothesis seems equally applicable to gauze flames, as nothing can prevent smoke-rings after smoke-rings from rolling up the contiguous sides of parallel jets nearly in contact with each other. Indeed, the difficulty of access of the outer air to the spaces between the jets must favour the production of *vacua* round the orifices, and accordingly the occurrence of air-whirls. This is perhaps the reason why wire-gauze flames begin to show sensitive properties at gas-pressures so much lower than those found necessary in the case of a single flame burning at a taper jet. The whole array of jets, it may be, in a wire-gauze flame behaves very nearly alike, and the flame as a body burns, whether noisily or silently, in the same manner, but with greatly increased susceptibility, as a single flame-jet from one of the gauze-meshes alone would appear to do. Whatever mechanical distinction may really exist between the mode of action of the common taper jet and the wire-gauze sensitive flames, it appears, therefore, rather to be one of a higher degree of susceptibility at low pressures, than of any more distantly distinct or special kind. Even the mode of operation of external sounds upon them is probably very similar in the two cases, for by rapid vibrations of the external air, such as a hiss or shrill whistle produces, the gas-jet leaving an orifice is shifted bodily to and fro over its edges, and nothing can more certainly produce partial *vacua*, and consequently air-whirls round its circumference, than sudden displacements of an air-jet laterally over the sides of its aperture, even if the tendency to develop them more or less periodically did not exist already in the critical or "sensitive" condition of the jet. Axial vibrations, also, or those impressed by outer disturbances on the gas-current in the orifice in the direction of its flow, cannot be altogether without effect in producing *vacua* and air-whirls at its mouth; and among the multitudes of them thus occurring from the impressed action of external vibrations in all directions, a rhythmical selection is probably made depending on the form of the burner and the pressure of the gas. It is difficult to imagine how the partial air-vacuum or aspiration constantly existing round the nozzles of blast-apertures can bestow its energy when broken into discontinuity, rhythmical or otherwise, by a turbulent condition of the jet otherwise than by producing, in the peculiar eddy of its position, ring-shaped vortices encircling the blast; but it is evident that few jets and nozzles can be fashioned so smoothly in their inner and outer surfaces and edges that the ring vortices will often be complete; mere fragments of rings are scattered from their sides, which, having no stability, collapse with shocks and puffs that give the roaring and blustering character to the stream. With perfectly smoothed orifices there is probably every gradation according to the pressure of the gas, from full continuity of the partial vacuum or rarefaction round the jet, abating gradually and uniformly upwards to ultimate disappearance by friction with the surrounding air, through a condition of gentle undulations of this cone of rarefaction pursuing each other up the stream with slackening strength, and finally losing themselves also by friction as before, to the case of turbulence where the rings of rarefaction are quite intermittent, and separate ring-eddies more or less distinct from each other,

* The word "smoke-rings," as here used occasionally, is not intended to imply the presence of smoke in the jet or flame, but to denote by a familiar phrase an annular air-vortex having its rotation round a circular line or ring of lower pressure than that of the surrounding air. Such annular vortices are most easily seen in liquids by drawing a flat blade through them with its broad side in front; or, indeed, as was lately shown to me by Prof. James Thomson, who supplied me with their explanation, in a cup of tea, by drawing a spoon very gently through it. Only half of the annulus is formed, encircling the edge of the blade or spoon with a curved line of low pressure, round which the liquid spins as in a smoke-ring, and shows a little whirlpool on the surface, one at each point of intersection of the surface with the low-pressure line below it. If an oar-blade is drawn rather rapidly through water, groups of two or three of these ring-vortices following each other in its track can very readily be produced.

of greater or less strength, and travelling up the stream with different speeds, take the place of the more gentle undulations. The distinction between ring-vortices and ring-shaped undulations is perhaps here too strongly and improperly overdrawn, as, besides the improbability that effects so exaggerated as perfect air-whirls are really ever attained in ordinary gas-jets, the properties of the undulations that correspond to and lead up to them in ordinary currents must evidently resemble theirs in all respects, so that the deeper and stronger interior undulations move up the jet more rapidly than open and weaker exterior ones on the surface; for it seems probable that both vortices and ring-waves of strongest rarefaction will generally occur nearest to the centre or axis, and those of weakest rarefaction furthest from it, or nearer to the slow-moving outer surface of the jet. The effect of the collision and destruction of a weaker by a stronger ring-wave, when they overtake each other, is the same as that of perfect circulating whirls; the balance of pressure in one part of the circular wave being broken by a shock, it collapses in every other part, and if both waves are destroyed, the further progress of the jet is intercepted at that point, and it scatters itself in a confused cloud at the point of concourse and disruption of the waves. The long-enduring smoke- or steam-rings often seen projected from the funnels of locomotive engines at starting, or when moving slowly and emitting separate puffs, illustrate apparently the mutual action of closely packed parallel jets like those of an ordinary gauze flame; for the impeded passage to the outer air offered by a number of such surrounding jets, just as by the funnel of the locomotive engine, favours the production of a strong vacuum round the jet-aperture or blast-pipe, and of a strong wave or steam-ring, the moment that the jet or blast takes a side-swing or a sudden leap upwards that calls the action of the partial vacuum into play.

A. S. HERSCHEL

(To be continued.)

A New and Simple Method for making Carbon Cells and Plates for Galvanic Batteries

SOME time since a correspondent asked for an easy method to construct carbon plates. A paper of mine was read in Section A at Belfast on the subject, and as it describes a process by which any experimentalist can construct not only plates but cells of carbon, I have thought a condensed account of the process may be appropriate for your columns.

With a syrup made of equal quantities of lump-sugar and water, mix wood-charcoal in powder with about a sixth part of a light powder sold by colourmen, called vegetable black. The mixture should hang thickly on any mould dipped into it, and yet be sufficiently fluid to form itself into a smooth surface. The vegetable black considerably helps in this respect.

Moulds of the cells required are made of stiff paper, and secured by wax or shellac. A projection should be made on the top of the mould for a connecting piece. These moulds are dipped into the carbon syrup, so as to cover the outside only, and then allowed to dry. This dipping and drying is repeated until the cells are sufficiently thick. When well dried they are then buried in sand, and baked in an oven sufficiently hot to destroy the paper mould. When cleared from the sand and burnt paper the cells are soaked for some hours in dilute hydrochloric acid, and again well dried, then soaked in sugar syrup. When dry they are then packed with sand in an iron box, gradually raised to a white heat and left to cool. Should some of the cells be cracked, they need not be rejected, but covered with paper or plaster and dipped in melted paraffin.

Rods or plates of carbon can be rolled or pressed out of a similar composition, but made thicker. Carbon thus made will be found to have a good metallic ring and a brilliant fracture.

Barnstaple, Oct. 26 W. SYMONS.

Ingenuity in a Spider

A SPIDER constructed its web in an angle of my garden, the sides of which were attached by long threads to shrubs at the height of nearly three feet from the gravel path beneath. Being much exposed to the wind, the equinoctial gales of this autumn destroyed the web several times.

The ingenious spider now adopted the contrivance here represented. It secured a conical fragment of gravel with its larger end upwards, by two cords, one attached to each of its opposite sides, to the apex of its wedge-shaped web, and left it suspended as a moveable weight to be opposed to the effect of such gusts of air as had destroyed the webs previously occupying the same situation.

The spider must have descended to the gravel path for this special object, and, having attached threads to a stone suited to its purpose, must have afterwards raised this by fixing itself upon the web, and pulling the weight up to a height of more than two feet from the ground, where it hung suspended by elastic cords. The excellence of the contrivance is too evident to require further comment.

Torquay, Oct. 26 JOHN TOPHAM

Note on the Rhynchosaurus Articeps, Owen

REFERRING lately to Prof. Owen's description of the Rhynchosaurus ("Palæontology," p. 264), first discovered by myself in 1838–39, in the New Red Sandstone of Grinshill, near Shrewsbury, I remarked that in speaking of the ichnolites supposed to belong to this animal he says there is an "impression corresponding with the hinder part of the foot, which reminds one of a hind toe pointing backwards, and which, like the hind toe of some birds, only touched the ground." In this account nothing is said of any claw being attached to this hind toe, nor have I met with any description of a claw in other authors. I have therefore thought it worth while to mention that I possess a specimen from Grinshill that shows distinctly the impression of a straight claw pointing backwards. There is also, on the same slab, the impression of another smaller foot of only three toes with strong straight claws, which has behind it a slight impression corresponding with the hind toe of the larger footprints. It is a curious fact that the claws of the larger impression, though larger than those of the smaller footprint, are so much recurved as not to project much beyond the ends of the toes, while on another slab from Storeton there are reliefs with both straight and recurved claws, the latter giving the idea of a foot like that of the Great Anteater. In these Storeton ichnolites the hind toe exhibits no claw, nor am I sure whether certain rounded elevations represent the smaller footprint in the Grinshill specimen. Upon another slab of Storeton stone I have a mark resembling the tail-mark on the slab presented by Mr. Strickland to the Warwickshire Museum, but unfortunately the footmarks connected with it are too indistinct to decide its origin. In a third slab from Storeton, besides several impressions with straight claws, there is one three inches long, the second toe of which has a straight claw $\frac{5}{8}$ in. in length. I have also Cheirotherium footprints with long straight claws from the same quarries.

I have put these few remarks together to fulfil the wish of Prof. Owen "to obtain the means of determining the precise modifications of the locomotive extremities of the Rhynchosaurus." Perhaps by this time this object may have been attained, for at the Congrès des Savans at Paris in 1868 the discovery of two almost perfect skeletons was announced, and drawings of them were exhibited by a professor from Lyons.

T. OGIER WARD

[So far as the photographs can be deciphered, they seem to bear out the writer's statements.—ED.]

THE ALPINE CLUB MAP OF SWITZERLAND*

IN NATURE, vol. vi. p. 203, we adverted to the non-existence of a map of the Alps on a scale sufficiently large for general purposes, and briefly referred to the map which was then being produced under the direction of a committee of the English Alpine Club with the view of supplying the want. This map, though not yet finished, has been recently published. Three sheets are completely finished, but the fourth is still in outline, and will be exchanged for perfect copies when the hill-shading is added.

We believe this to be, so far as it extends, the most exact map of the Alps which has yet appeared, and probably no map of its size has ever been produced in this country with more beautiful workmanship or with greater

* The Alpine Club Map of Switzerland with parts of the neighbouring countries. Edited by R. C. Nichols, F.S.A., F.R.G.S., under the superintendence of a Committee of the Alpine Club. In four sheets. Scale $\frac{1}{250000}$. (Stanford, 1874.)